SPECIFICATION

REFRIGERATOR

Technical field

The present invention relates to a refrigerator furnished with an ion generating apparatus for generating positive and negative ions to be released into the living space outside the refrigerator.

Background art

An example of a conventional refrigerator is disclosed in Japanese Patent Application Laid-Open No 2002-95731. This refrigerator is furnished with a means for generating positive and negative ions for the purpose of killing airborne germs present in the cold air inside the refrigerator.

This conventional technique aims at killing microbes floating in the cold air inside the refrigerator, and therefore, for this technique to work, it is at least necessary that microbes that have entered the refrigerator from the living space outside it float in the cold air by themselves or in a form attached to particles.

In fact, however, it has been found that a large number of microbes are present inside a refrigerator furnished with an ion generating apparatus which is in actual use. Thus, it has been confirmed that part of the microbes that have entered the refrigerator do not float but remain inside it under the electric charge of molded components.

Part of those microbes that remain attached under electric charge inside the refrigerator are considered to have been, before settling inside it, airborne microbes that

entered the refrigerator from the living space outside the refrigerator where it is installed. This means that, even if the interior of the refrigerator is sterilized, airborne germs enter it whenever the door is opened. Thus, when evaluated from the perspective of a refrigerator, the ion generating means used in the aforementioned conventional construction does not function as an effective sterilizing means.

Needless to say, it is possible to separately install an air purifier having such a capability in the living space where the refrigerator is installed in order to prevent entry of airborne germs into it from outside. However, considering modern house designs, this is not a solution for everyone because of the extra space occupied by the separate unit.

An object of the present invention is to provide a refrigerator that prevents entry of microbes into it from outside without occupying an unduly large space and that removes airborne germs present in the living space so as to cut off their way of entry and thereby achieve a more hygienic environment inside the refrigerator.

Disclosure of the invention

To achieve the above object, according to the present invention, a refrigerator is provided with ion generating means, and positive and negative ions are released into a living space outside the refrigerator.

With this construction, by releasing positive and negative ions into a living space outside the refrigerator, it is possible to remove airborne germs present in the living space and thereby produce a hygienic living space. In particular, by releasing the positive and negative ions to outside the door of a storage compartment of the refrigerator, it is possible to prevent entry of airborne germs into the refrigerator from outside when a door is opened and closed. This makes it possible to produce a hygienic environment inside the refrigerator.

The ion generating means may be built as a unit by being housed inside a casing unit. This makes the ion generating means easy to attach to and detach from the refrigerator and thus easy to handle. For example, the ion generating means is built as a unit having a blower and an ion generating apparatus housed inside a casing unit.

The air inlet of the ion generating means may have an opening pointing downward.

With this construction, it is possible to prevent entry of particulate dust that falls from above, and prevent entry of liquid such as water. This helps avoid deterioration of performance or failure.

According to the present invention, in a refrigerator, an ion generating means is built into and thereby integrated into a control panel for making various settings, for example, for adjustment of the temperature inside a storage compartment.

In this construction, the ion generating means is built into and thereby integrated into the control panel. This helps save space without reducing the space inside the storage compartment and without spoiling the functions and appearance of the refrigerator. Moreover, by locating the air outlet of the ion generating means directly in the front face of the control panel without a detour through a pipe or the like, it is possible to efficiently release ionized air and simultaneously save space.

According to the present invention, the air outlet of the ion generating means may be located in the front face of the control panel.

With this construction, it is possible to effectively release ionized air into the living space outside, especially in front of and around, the refrigerator. Moreover, since the air outlet is located in the front face of the control panel, it is possible to check whether the ion generating means is operating or not easily as by placing a hand in front of the air outlet while operating the refrigerator.

According to the present invention, the air inlet of the ion generating means may be located in the bottom face of the control panel and above a recess formed, as a door handle for the storage compartment, below the control panel.

In this construction, air is sucked into the ion generating means through the vicinity of the space created by the recess serving as the door handle. This enhances suction efficiency. Moreover, by locating the air inlet in the bottom face of the control panel, it is possible to prevent entry of particulate dust that falls from above, and prevent entry of liquid such as water. This helps avoid deterioration of performance or failure.

According to the present invention, a dustproof filter may be detachably attached to the air inlet of the ion generating means.

With this construction, it is possible to prevent entry of particulate dust into the ion generating means and thereby prevent dust from collecting in the ion generating electrode portion. This helps avoid deterioration of performance.

Since this dustproof filter is detachably attached to the casing unit, it is easy to clean it regularly and replace it whenever necessary. This ensures hygienic use, and helps prevent deterioration of performance resulting from clogging of the dustproof filter.

According to the present invention, the casing unit may be provided with water damage preventing means for preventing liquid such as water that has entered the casing unit through the air outlet thereof from reaching the ion generating apparatus.

In this construction, even if liquid such as water has entered the casing unit through the air inlet thereof, the water damage preventing means prevents the ion generating apparatus and other components housed inside the casing unit from being affected.

The water damage preventing means may be realized with the air inlet formed in the casing unit and a drain hole formed separately from the air outlet. Even if liquid such as

water has entered the casing unit through the air inlet thereof, it can be drained out of it through the drain hole.

In a case where the casing unit is built into the control panel for making various settings, for example, for adjustment of the temperature inside the storage compartment, a drain hole may be formed in a bottom portion of the control panel so as to correspond to the drain hole formed in the casing unit. This permits liquid such as the aforementioned water drained out of the casing unit to be drained out of the control panel through the drain hole formed therein, and thus prevents the components housed inside the control panel from being affected. As the water damage preventing means, a water damage preventing rib may be formed so as to protrude upward from a bottom portion of the casing unit in the air passage between the air outlet formed in the casing unit and the ion generating apparatus. This helps prevent liquid such as water from reaching the ion generating apparatus.

The control panel may be located at a height of 800 mm to 1 100 mm from the floor surface of the refrigerator body. This makes it possible to prevent ionized air from being blown directly onto the face of infants (the average height of one-and-a-half-year-old infants, who start walking steadily, is about 800 mm, and thus the aforementioned height is effective in preventing ionized air from being blown onto the face of, at least, infants at such ages that they toddle supported or unsupported) without spoiling the operability with which adults can operate the refrigerator. Thus, it is possible to achieve safety and usability simultaneously.

According to the present invention, in a refrigerator, an ion generating means is located in a ceiling portion of the refrigerator body.

With this construction, it is possible to release positive and negative ions into the living space outside, especially in front of, the refrigerator. Thus, it is possible to kill airborne germs present in the living space and thereby produce a hygienic living space.

Simultaneously, it is possible to prevent entry of airborne germs into the refrigerator from outside when a door is opened and closed and thereby produce a hygienic environment inside the refrigerator.

In particular, according to the present invention, the ion generating means is located in a ceiling portion of the refrigerator body. This makes it possible to release ionized air containing positive and negative ions from a high position. This ensures that the ions are spread over a wide area, and thus helps enhance the antimicrobial effect on airborne germs outside the refrigerator.

According to the present invention, since the ion generating means is located in a ceiling portion of the refrigerator body, it is easy to fit an ion generating apparatus to a refrigerator having no ion generating apparatus simply by changing the design of the ceiling portion thereof. Moreover, such a refrigerator can be manufactured without design changes in the interior or doors thereof, and this helps reduce costs.

The ion generating means may be located anywhere so long as ions can be released into the living space in front of the ceiling portion of the refrigerator. For example, the ion generating means can be located in the front face of the ceiling portion, where a fitting member for fitting the door hinge for the topmost storage compartment is formed so as to protrude therefrom, by the use of the space created in front of the ceiling portion by the fitting member.

In a case where, as the fitting member, a hinge fitting plate for fitting the door hinge for a storage compartment is provided in a ceiling portion of the refrigerator and the refrigerator is provided with a box-shaped member having the hinge fitting plate covered with a cover, the space created inside the box-shaped member may be used to house the ion generating means inside the box-shaped member. This makes it possible to effectively use

space. In particular, in a case where the door is openable from either side, hinge fitting plates are provided at both the left-hand and right-hand sides thereof. Thus, the space left between the left-hand and right-hand hinge fitting portions can be used to accommodate the ion generating means. Moreover, in a case where the entire left-hand and right-hand hinge fitting portions are covered with a cover, the ion generating means may be placed in the space between the space between the hinge fitting portions and the cover.

The air outlet of the ion generating means may be formed in the front face of the box-shaped member so that all doors are located below the air outlet. This makes it possible to effectively prevent entry of airborne germs into the refrigerator.

A recess may be formed in a front bottom portion of the box-shaped member, with the air inlet of the ion generating means formed in the bottom face of the box-shaped member so as to face the recess. This recess helps widen the gap between the casing unit and the door, and thus permits an ample amount of air to be sucked in through the air inlet even when the door is closed.

By blowing out ionized air in one direction, it is possible to effectively release ionized air into the living space in front of each door or the refrigerator body. This eliminates the need to provide a louver for varying the direction in which ionized air is blown out.

Brief description of drawings

Fig. 1 is a front view of the refrigerator of a first embodiment of the invention.

Fig. 2 is a front view showing the construction of the control panel shown in Fig. 1.

Fig. 3 is a sectional view showing the construction of the control panel shown in Fig. 2.

Fig. 4 is a bottom view, as seen from below, of the control panel shown in Fig. 2, with the dustproof filter attached to the air inlet of the casing unit.

Fig. 5 is a bottom view, as seen from below, of the control panel shown in Fig. 2, with the dustproof filter detached from the air inlet of the casing unit.

Fig. 6 is a sectional view showing the construction inside the casing unit shown in Fig. 3.

Fig. 7 is a sectional view along line X-X shown in Fig. 6.

Fig. 8 is a circuit diagram showing an example of the configuration of the ion generating apparatus shown in Fig. 3.

Fig. 9 is an external view showing an example of the ion generating apparatus shown in Fig. 3.

Fig. 10 is a front view of the refrigerator of a second embodiment of the invention.

Fig. 11 is a top view of the refrigerator of the second embodiment.

Fig. 12 is a sectional view showing the construction inside the ceiling portion of the refrigerator shown in Fig. 11.

Fig. 13 is a sectional view along line A-A shown in Fig. 12.

Fig. 14 is a sectional view along line B-B shown in Fig. 12.

Best mode for carrying out the invention

A first embodiment of the present invention will be described with reference to the drawings. Fig. 1 is an overall view of the refrigerator of the first embodiment of the invention. Fig. 2 is a front view showing the construction of the control panel shown in Fig. 1. Fig. 3 is a sectional view showing the construction of the control panel. Fig. 4 is a bottom view, as seen from below, of the control panel, with the filter attached to the air inlet of the casing unit. Fig. 5 is a bottom view, as seen from below, of the control panel, with the filter detached from the air inlet of the casing unit.

As shown in Fig. 1, in an upper portion of a refrigerator body 1, there is provided a refrigerator compartment 2, and, in a lower portion of the refrigerator body 1, there are provided an ice-maker compartment 3 and a freezer compartment 4 on the right and a vegetables compartment 5 on the left. These compartments are separated from one another with heat-insulating partition walls 1a. Of these partition walls 1a, the one 1a that separates the refrigerator compartment 2 from the ice-maker and vegetables compartments 3 and 5 is located at a height of 800 mm to 1 100 mm (specifically, 910 mm in Fig. 1) from the floor surface. In the front face of this partition wall 1a, there is provided a control panel 6. As shown in Fig. 3, a casing unit 8 is built into and thereby integrated into this control panel 6. The casing unit 8 is built as a unit incorporating an ion generating apparatus 7 that generates positive and negative ions and a blower 21 that releases the generated positive and negative ions, in a stream of air, into the living space outside the refrigerator.

The control panel 6 has a box-shaped panel body 6a that is open at the rear, and, in a central portion of this panel body 6a, there is provided a display portion 9 for displaying the operation status of the refrigerator and other monitored information. To the right of the display portion 9, there is provided an operation panel 10 provided with operation buttons for making various settings on the refrigerator, and, to the left of the display portion 9, there is formed an air outlet 11 of the casing unit 8. To the right of the air outlet 11, there is provided an operation portion 12 for turning the ion generating apparatus 7 on and off and for switching between different ion generation balance settings.

Figs. 4 and 5 show how a dustproof filter 14 is attached to and detached from an air inlet 13 formed in the control panel 6. As shown in these figures, in a left-hand end portion of the bottom face of the control panel 6, there is formed an opening 16 with a grating which communicates with the air inlet 13, and this opening 16 is located above a recess 17 formed,

as the upper door handle for the vegetables compartment 5, below the control panel 6.

A dustproof filter 14 is detachably attached to the opening 16 formed in the bottom face of the control panel 6. This dustproof filter 14 removes particulate dust from the air sucked in through the air inlet 13 of the casing unit 8, and thereby prevents deterioration of performance resulting from dust collecting in the discharge electrode portion of the ion generating apparatus 7.

The dustproof filter 14 is formed of resin net fitted to a resin frame, and is fixed to the bottom face of the control panel 6 with claws. The dustproof filter 14 is made of a soft, easily deformable material, and can thus be easily detached from the control panel 6.

As shown in Figs. 3 and 6, the casing unit 8 is built as a unit composed of a case 40 made of resin molded in a cylindrical shape, the ion generating apparatus 7 for generating positive and negative ions, and the blower 21 for blowing out the generated ions. The ion generating apparatus 7 consists of a discharge electrode portion and a drive circuit that supplies a voltage to the discharge electrode portion. In the bottom face of the case 40 is formed the air inlet 13, and in the front face of the case 40 is formed the air outlet 11. Thus, an air passage 20 is formed that runs from the air inlet 13 to the air outlet 11. The ion generating apparatus 7 is placed in a middle portion of the air passage 20 so as to face it, and the blower 21 is placed above the air inlet 13.

The wall surface of the case 40 that faces the air passage 20 is covered with a conductive material such as aluminum tape. The case 40, which is a resin molding, is easily charged electrically. This tends to cause ions to attach to the wall surface. By making the wall surface of the case 40 conductive, it is possible to prevent ions from attaching to the wall surface and thereby reduce the loss of ions inside the air passage 20. In this way, it is possible to let a sufficient amount of ions be blown out through the air outlet 11.

The air outlet 11 formed in the front face of the control panel 6 is open toward the living space outside, especially in front of, the refrigerator, so that ionized air sterilizes the living space outside, especially in front of. the refrigerator, and prevents entry of airborne germs into the refrigerator. The air outlet 11 may be provided with a louver 11a (see Fig. 2) so that the direction in which ionized air is blown out can be varied electrically or manually. By electrically operating the louver 11a all the time, it is possible to agitate the air in the living space and thereby enhance sterilization efficiency.

Fig. 6 is a diagram showing the construction inside the casing unit, and Fig. 7 is a sectional view thereof along line X-X. As shown in these figures, in the portion of the air passage 20 located on the downstream side of the ion generating apparatus 7, there is provided water damage preventing means 22 for preventing liquid such as water that has entered the casing unit through the air outlet 11 from reaching the ion generating apparatus 7.

The water damage preventing means 22 is composed of a water damage preventing rib 23 that protrudes upward from the bottom face of the casing unit 8 in the portion of the air passage 20 located on the downstream side of the ion generating apparatus 7, a water trap 24 formed as a lowered portion in the bottom face of the casing unit 8 on the downstream side of the water damage preventing rib 23 near the air outlet 11, and a drain hole 25 formed in the bottom face of the water trap 24. The water damage preventing means 22 may be realized with at least one of the rib 23, water trap 24, and drain hole 25.

Moreover, as shown in Fig. 4, in the bottom face of the control panel 6, there is formed a drain hole 26 so as to correspond to the drain hole 25 formed in the casing unit and thereby permit liquid, such as the water that has entered the casing unit 8 from outside and drained out of it through the drain hole 25 thereof, to be drained out of the control panel 6.

The blower 21, which is placed above the air inlet 13 of the casing unit 8, is a

centrifugal blower having a fan with multiple narrow wings. The blower 21 sucks in air from below and sends it out in the horizontal direction.

Fig. 8 is an electrical circuit diagram of the ion generating apparatus 7, which is of the surface discharge type, and Fig. 9 is an external perspective view of the ion generating apparatus 7. As shown in these figures, the ion generating apparatus 7 is composed of an electrode portion 7a placed near the front opening of a casing 71 and a high-voltage power supply portion 7b housed inside the casing 71.

The electrode portion 7a of the ion generating apparatus 7 is fitted with a chip heater 54, which prevents failure of discharge as when highly humid air passes through the electrode interface. In the high-voltage power supply portion 7b of the ion generating apparatus 7, one end of a secondary line of a step-up transformer 55 is connected through a relay 56 back to an alternating-current (AC) line. Thus, the high-voltage power supply portion 7b has a circuit configuration such that, when the relay 56 is open, positive and negative are generated in equal amounts and, when the relay 56 is closed, negative ions are selectively generated.

Although an alternating-current power source is used as a drive power source 57 for the ion generating apparatus 7 in Fig. 8, the circuit configuration may be so modified as to use a direct-current power source. In a case where a direct-current power source is used, the output tends to be lower than when an alternating-current power source is used, and therefore, when high-load electrodes are used, it is necessary to take some measures to cope with it as by using means of stepping up the voltage in two steps.

Moreover, as shown in Fig. 3, the ionizer portion 20a of the air passage 20 facing the electrode portion 7a is given a cross-sectional area equal to that of the outlet 21a of the blower 21. This helps alleviate the pressure loss in the air blown out by the blower 21, and thus helps send out a sufficient amount of air at a sufficient rate. Thus, it is possible to generate

ionized air with high efficiency.

Next, the operation of the casing unit 8 constructed as described above will be described. When the refrigerator body 1 is energized, and the ion generating apparatus 7 is turned on by operating the operation panel 10, the ion generating apparatus 7 and the blower 21 start operating simultaneously. As a result, the air sucked in through the air inlet 13 from the living space outside the refrigerator passes through the dustproof filter 14, is then ionized in the ionizer portion 20a, then passes through the air passage 20, and is then released through the air outlet 11.

In the ion generating apparatus 7, when a positive or negative high voltage higher than the discharge start voltage is applied from the high-voltage power supply portion 7b to between the electrodes of the electrode portion 7a, electric discharge occurs, producing a strong electric field. This causes electrical breakdown in air containing moisture, generating positive and negative ions. The voltage applied is, preferably, in the range of 3.2 kV to 5.5 kV, depending on the structure of the electrodes.

Meanwhile, the air sent into the air passage 20 by the blower 21 passes by the surfaces of the discharge electrodes of the ion generating apparatus 7. Here, air that passes close to the surfaces is ionized into positive and negative ions as described above, and the resulting ionized air is released into the space outside, especially in front of, the refrigerator. As a result, microbes floating in the space outside, especially in front of, the refrigerator is killed by being subjected to the sterilizing effect brought about in the following manner.

When the output voltage is positive, positive ions, mainly $H^+(H_2O)_n$, are generated. When the output voltage is negative, negative ions, mainly $O_2^-(H_2O)_m$, are generated. These ions $H^+(H_2O)_n$ and $O_2^-(H_2O)_m$ gather together around the surfaces of microbes, and thus enclose airborne germs such as microbes floating in the air. Then, according to formulae (1)

to (3) below, the ions, by colliding with one another and thus gathering together, produce a radical such as [·OH] (hydroxyl radical) or H_2O_2 (oxygen peroxide) on the surfaces of microbes or the like and thereby kill airborne germs.

$$H^+(H_2O)_n + O_2^-(H_2O)_m \rightarrow \cdot OH + 1/2O_2 + (n+m)H_2O \quad (1)$$

$$H^+(H_2O)_n + H^+(H_2O)_{n'} + O_2^-(H_2O)_m + O_2^-(H_2O)_{m'} \rightarrow 2\cdot OH + O_2 + (n+n'+m+m')H_2O \quad (2)$$

$$H^+(H_2O)_n + H^+(H_2O)_{n'} + O_2^-(H_2O)_m + O_2^-(H_2O)_{m'} \rightarrow H_2O_2 + O_2 + (n+n'+m+m')H_2O \quad (3)$$

By releasing a sufficient amount of positive and negative ions to kill airborne germs present in the living space in this way, it is possible to prevent microbes from entering the refrigerator from outside when the door of the refrigerator compartment 2 or vegetables compartment 5, which tends to be opened and closed frequently, is opened and closed. This helps produce a more hygienic environment inside the refrigerator.

Moreover, since the ion generating apparatus 7 and its operation portion 12 are located at a height of 800 mm to 1 100 mm from the floor surface of the refrigerator. This prevents ionized air to be blown directly only the face of infants who are younger than one and a half year (with an average height of about 800 mm), which is the age at which they start walking steadily, and thus who still toddle supported or unsupported. Moreover, this is achieved without spoiling the operability with which adults can operate the refrigerator.

Moreover, the casing unit 8, which is built as a unit, is built into and thereby integrated into the control panel 6. This helps save space without reducing the spaces inside the storage compartments and without spoiling the functions and appearance of the

refrigerator. Moreover, the air outlet 11 of the casing unit 8 is located directly in the front face of the control panel 8 without a detour through a pipe or the like. This helps efficiently release ionized air and simultaneously save space.

Furthermore, since the air outlet 11 is located in the front face of the control panel 6, it is possible to check whether the casing unit 8 is operating or not easily as by placing a hand in front of the air outlet 11 while operating the refrigerator. Moreover, the air inlet 13 of the casing unit 8 is located above the door handle for a storage compartment, such as the vegetables compartment 5, so that air is sucked into the casing unit 8 through the vicinity of the space created by the recess 17 formed as the door handle. This enhances suction efficiency. Moreover, by locating the air inlet 13 in the bottom face of the control panel 6, it is possible to prevent entry of particulate dust that falls from above, and prevent entry of liquid such as water. This helps avoid deterioration of performance or failure.

Moreover, by operating the operation portion 12, the ion balance can be varied so that the ion generating apparatus 7 selectively releases a large amount of negative ions. This makes it possible to obtain a relaxing effect on the human body. In particular, in a case where a large amount of negative ions is selectively generated, by operating the louver 11a, ionized air can be directed to a space such as a kitchen or the like where a person spends time in a fixed position so as to efficiently obtain a relaxing effect on the human body.

This embodiment deals only with ion generating means for releasing ions to outside a refrigerator. Needless to say, it is also possible to provide ion generating means inside the refrigerator. In the embodiment described above, the ion generating means is placed in the control panel provided in the front face of the partition wall separating the storage compartments. It is, however, also possible to place the casing unit of the ion generating means in the door of a storage compartment of the refrigerator.

Next, a second embodiment of the present invention will be described with reference to the drawings. Fig. 10 is a front view of the refrigerator of the second embodiment of the invention. Fig. 11 is a top view of the refrigerator. Fig. 12 is a diagram showing the construction inside the ceiling portion of the refrigerator shown in Fig. 11. Fig. 13 is a sectional view along line A-A shown in Fig. 12. Fig. 14 is a sectional view along line B-B shown in Fig. 12.

As shown in Fig. 10, the refrigerator of this embodiment has, in an upper portion of a refrigerator body 1, a refrigerator compartment 27 and, below it, a freezer compartment 28 and a vegetables compartment 29. These compartments are separated from one another with heat-insulating partition portions. The refrigerator compartment 27 is openable with a door 30 pivoted at the front thereof. Likewise, the freezer compartment 28 and the vegetables compartment 29 are respectively openable with doors 31 and 32 pivoted at the front thereof. The doors 30, 31, and 32 are openably supported by hinges. In the refrigerator of this embodiment, the hinges are provided at both the left-hand and right-hand sides of the door so that the door is openable from either side.

As shown in Figs. 11 to 13, a ceiling portion 33 of the refrigerator 1 is composed of a top surface portion 33a and a front portion 33b that are flush with each other. The front portion 33b is shaped like a box by being composed of a support member 35 for holding a hinge fitting plate 34 to which the hinges are fitted and a cover 36 for covering the support member 35 from above to conceal the hinge fitting plate 34.

The hinge fitting plate 34, which has the hinges fitted thereto at both ends, is so shaped as to protrude frontward in a left-hand and a right hand portion thereof, and is recessed in a central portion thereof. In this central portion is placed the casing unit 8 described earlier. The casing unit 8 has its case 40 fitted to the support member 35 with screws or the

like. Next to the casing unit 8, there is placed a circuit board holding member 38 for holding an operation circuit board 39 upright. The operation circuit board 39 is a circuit board for operating the casing unit 8.

The air inlet 13 (see Fig. 14) of the casing unit 8 is fitted with a dustproof filter 46. This dustproof filter 46 removes particulate dust from the air sucked in through the air inlet 13 of the casing unit 8, and thereby prevents deterioration of performance resulting from dust collecting in the discharge electrode portion of the ion generating apparatus 7.

As shown in Fig.10, on the front face of the support member 35, there are provided, on the left, a display portion 47 for displaying the operation status of the casing unit 8 and other monitored information and, on the right, an operation portion 48 for operating the casing unit 8. At the center, there is formed an opening 41 that faces the air outlet 11 so as to permit ionized air to be blown out therethrough. Furthermore, as shown in Figs. 13 and 14, the front bottom surface of the support member 35 faces the door 30 of the refrigerator compartment 27, and has a recess 49 formed in a central portion thereof. In the recess 49, there is formed an opening 42 so as to face the air inlet 13 of the casing unit 8 to permit air outside the refrigerator to be sucked in therethrough. This recess 49 helps widen the gap between the support member 35 and the door 30, and thus makes it possible to suck in an ample amount of air through the air inlet 13 even when the door 30 is closed.

Next, the operation of generating ions in the construction described above will be described. When power is turned on by operating the operation portion 48, the casing unit 8 is energized. The ion generating apparatus 7 and the blower 21 start operating simultaneously. Thus, air outside the refrigerator is sucked into the case 40 through the opening 42 and the air inlet 13. The air sucked in passes through the dustproof filter 46, and flows through the air passage 20. The positive and negative ions generated by the ion

generating apparatus 7 is carried by the passing air, and thus the air becomes ionized. This ionized air is blown out through the air outlet 11 and the opening 41.

In this way, ionized air is blown out from the ceiling portion 33. Thus, the ionized air blown out of the refrigerator reaches far and is spared over a wide area. The positive and negative ions kill airborne germs present in the living space, and thereby reduces the airborne germs present in the vicinity of the refrigerator body 1. Thus, ionized air shuts the front of the refrigerator body 1, and produces a living space with reduced airborne germs. Even when any of the door 30, 31, and 32 is opened and closed, airborne germs are prevented from entering the refrigerator from outside. Thus, it is possible to realize a more hygienic environment both inside and outside the refrigerator.

By setting the blow-out direction of the air outlet 11 downward, it is possible to form a curtain of ionized air in front of the refrigerator body 1. This air curtain cuts off the way of entry through which airborne germs approach the refrigerator body 1, and thus helps to more securely prevent entry of airborne germs into the refrigerator.

Many modifications are possible in this embodiment. For example, the ion generating apparatus 7 or the casing unit 8 may be placed in the top face of the ceiling portion. Separate ion generating apparatuses may be provided to release ions to outside and inside the refrigerator. Although this embodiment deals with a door that is openable from either side, it is also possible to apply the invention to a door that is openable from one side. Specifically, in a case where a hinge fitting plate that has a hinge fitted thereto at one end is adopted, the ion generating apparatus 7 or the casing unit 8 can be placed in the space left by the side of the frontward protruding portion of the hinge fitting plate in front of the ceiling portion.

Industrial applicability

As described above, according to the present invention, a refrigerator is furnished with ion generating means that releases a sufficient amount of ionized air to produce a sterilizing effect into the living space outside, especially in front of, the refrigerator. With the resulting excellent sterilizing effect, it is possible to kill microbes floating in the living space without the use of an air purifier having such a function. Thus, it is possible to prevent entry of airborne germs into the refrigerator from outside, and thus to realize a hygienic environment inside the refrigerator.

Moreover, according to the present invention, the ion generating means is placed in the ceiling portion of the refrigerator body. With the resulting excellent antimicrobial effect, it is possible to eliminate airborne germs present in the living space outside the refrigerator. In this way, it is possible to produce a hygienic, comfortable living space, and to reduce airborne germs and thereby prevent airborne germs from entering the refrigerator from outside. Moreover, since the ionized air outlet is located in the ceiling portion, there is no risk of it being toyed with by an infant.

Furthermore, the space left in the ceiling portion is used, and therefore there is no need to newly secure a space in which to install an ion generating apparatus. This makes it possible to incorporate an ion generating apparatus into a refrigerator without significant design changes. Moreover, the interior and doors of the refrigerator can be used as they are without any changes in design. This helps reduce costs.